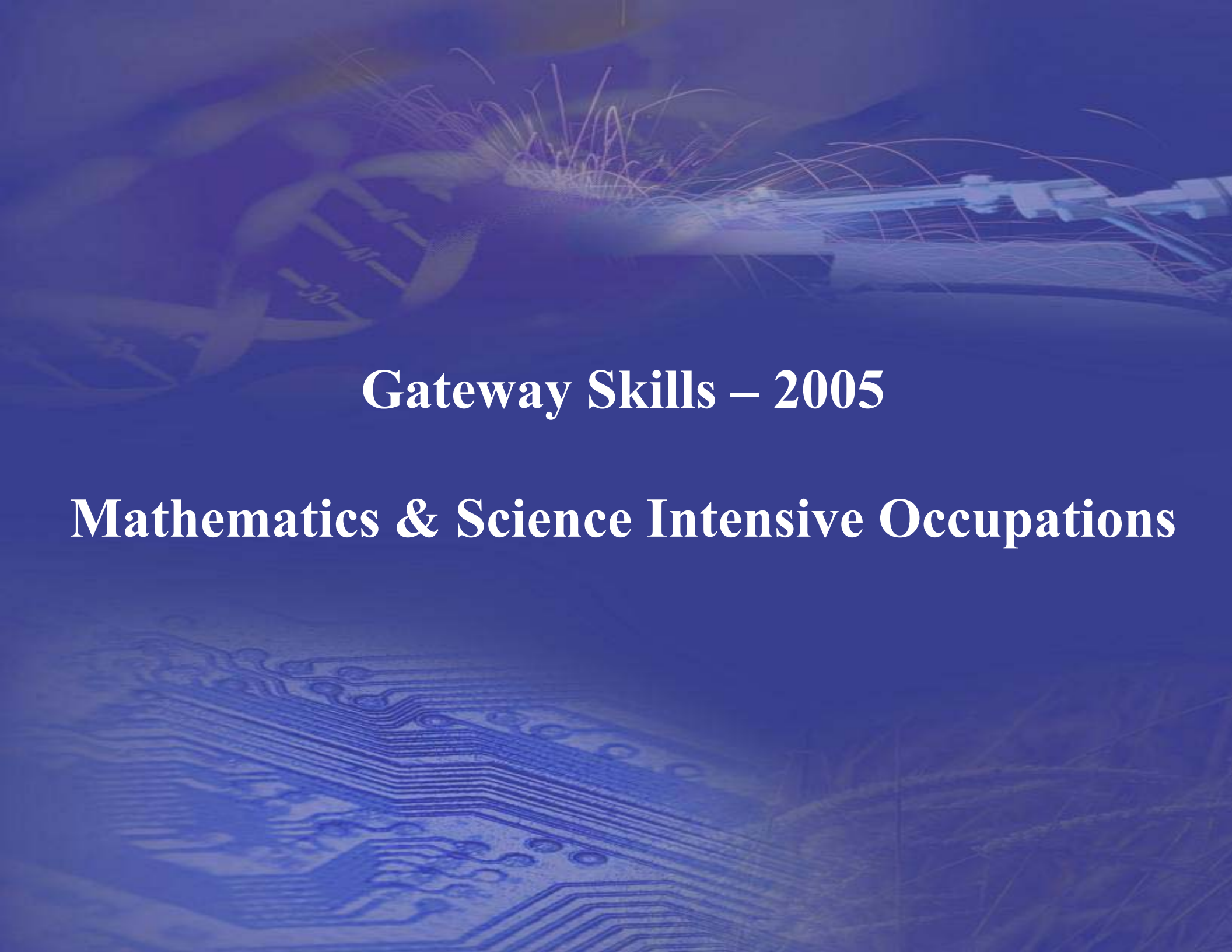

Gateway Skills – 2005

Mathematics & Science Intensive Occupations

“The industrialized world stands on the threshold of a technological revolution that will change the American way of life and the composition of the nation’s work force as much as the industrial revolution did a century ago…”

Testimony before a congressional subcommittee,
Charles Robb, National Governor’s Association

Key findings

- In 2002, there were 19,710 mathematics-intensive (annual mean wage $62,922) and 41,010 science-intensive jobs (annual mean wage $79,618) in Missouri, which all paid much higher salaries than the state average wage of $33,099.

- Workers in mathematics-intensive occupations accounted for 0.67% of all employment statewide with workers in science-intensive occupations accounting for 1.40%.

- Most mathematics-intensive jobs were in Professional and Business Services (7,869 jobs), Information (3,437 jobs), Education and Health Services (2,062 jobs), Government (1,814 jobs), and Manufacturing (1,633 jobs). There is a projected net change of over 4,400 mathematics-intensive jobs from 2002 to 2012 in Missouri.

- Most science-intensive jobs were in Education and Health Services (12,687), Professional and Business Services (10,644), Manufacturing (6,647), Government (2,829), Information (2,601), and Self-Employed Workers (2,221). There is a projected net change of over 8,000 science-intensive jobs from 2002 to 2012 in Missouri.

- In general, mean annual wages per job for most mathematics-intensive occupations were below the national averages. However, mean annual wages per job for many of the science-intensive occupations in Missouri were above the national average.

- Missouri institutions of higher education are producing fewer college graduates in science and mathematics-related fields than they did 20 years ago. The number of graduates obtaining any post-secondary degree (bachelor's, master's, or doctorate) in mathematics, education, life/physical science, and engineering has been steadily decreasing. The exception to this declining trend is in computer sciences, where the number of graduates attaining post-secondary degrees has significantly increased

- Of greatest concern is the fact that only 10.24% of Missouri's 10^{th} graders were proficient or advanced in mathematics and only 5.54% were proficient or advanced in science. This is a strong indicator that Missouri's K-12 student population is ill-equipped for post-secondary education in math or science-related subjects, and ill-equipped to immediately work after high school in occupations that require mathematics and science-related skills.

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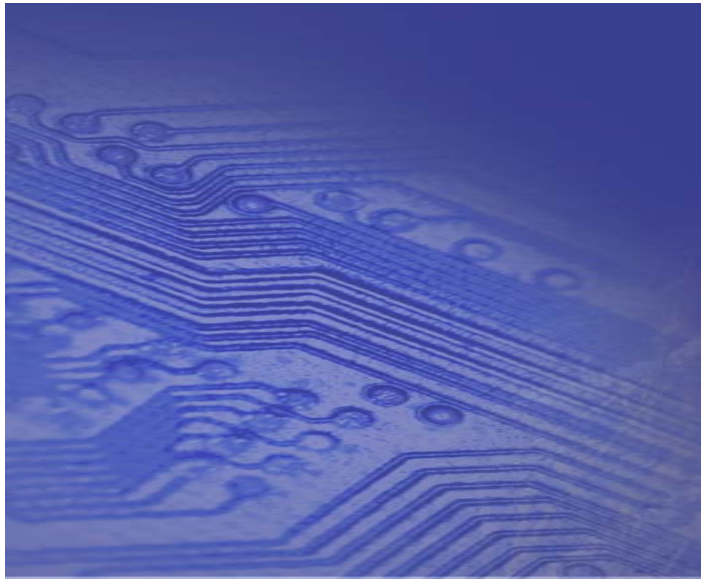


Overview

At the turn of the millennium, it became evident to the nation that our economy was in the process of transitioning from an asset-based to an intangible asset-based system.[1] In this new economy, copyrights, patents, branding, innovation, and knowledge are valued over more tangible assets such as stock or equipment. These intangible assets are critical in terms of making a company viably competitive on a national and even international scale. Many of these assets are products of industry innovation, spearheaded by human talent. Human innovation can provide industry with technical knowledge, help create new scientific discoveries and applications, and develop new ways in which to commercialize and position new products.[2]

"When businesses make location decisions, they are on the lookout not for iron ore or forests, rivers, or highways, but for people with ideas. The key to success in the knowledge-based economy is what economists call high human capital – what most of us would call talent."

Florida, R. & Gates, G.
Technology and Tolerance: Diversity and High Tech Growth

As such, it has been argued that both state and national economic growth are directly tied to innovation.[3] To remain competitive in a global market over the long-term, states must focus on educating their current and future workforce in science and mathematics to align worker skills with the needs of innovative businesses. A number of different governor's economic development strategies over the past few years have addressed the need to build their state's innovative capacity by: (1) providing training and education to meet industry needs, (2) promoting research and development in local universities and in the private sector, (3) supporting local entrepreneurs by providing venture capital funds and incentives for job creation, and (4) developing rural areas by supporting innovations in agriculture and supporting small business development.[4]

This report focuses on the need to provide training and education to meet the needs of innovative or high-tech industries in Missouri. High-tech industries are defined as industries that devote a high proportion of expenditures to research and development activities and employ a large amount of scientific, technical, and engineering personnel.[5] Instead of high-tech industries, this analysis focuses on high-tech occupations, i.e. those that require a high degree of knowledge in mathematics and science – two skills that have, in the past, been linked to occupations with job security, advancement, and high wages.

Methods

Occupations were classified as mathematics or science intensive if the combined importance and level of mathematics or science skills need to perform a particular job were two or more standard deviations above the mean mathematics or science skill level for all occupations. Skills refer to the developed capacities that facilitate learning and/or performance within occupations. Occupational skills data was taken from O*NET to be used in the analysis. For occupations that O*NET had divided out into several different occupations, the average of the importance (IM) for each occupation was calculated by totaling the IM scores for each of the new occupations and dividing by the number of new occupations that O*NET had created. This same process was used to create an average of the level (LV) for each occupation.

IM and LV scores were then summed and standardized. The scores were standardized based on a 13 point scale, which is the result of summing both the 5 point importance scale and the 7 point level scale. This inherently weights the level of a skill over the importance in the standardized score. This process generated a skills proficiency score that ranged from 0.0 (lowest skill proficiency) to 100.0 (highest skill proficiency).

$$\text{SKILL-PROFICIENCY}_{\text{occupation}i} = (((\text{SumIMLV}-1) / (13-1)) * 100)$$

Where:

SumIMLV = AvgIM + AvgLV
AvgIM = Average Skill Importance Score
AvgLV = Average Skill Level (Frequency of Use) Score

The data for this analysis comes from three principal sources. Information on occupational skill requirements was taken from a national database called the Occupational Information Network (O*NET), maintained by the U.S. Department of Labor. Occupational wage data for Missouri was taken from Occupational Employment Statistics (OES), maintained by the Missouri Department of Economic Development and the U.S. Department of Labor. Occupational employment data for Missouri was taken from Employment Projections, maintained by the Missouri Department of Economic Development and the U.S. Department of Labor.

Occupational Information Network (O*NET)

O*NET is a comprehensive database of worker attributes and job characteristics. The database contains information on knowledge, skill and ability requirements for 1,122 occupations. Although it is sometimes difficult to differentiate among knowledge, skill and ability in practice, they are distinct concepts in theory. Knowledge refers to information that has been acquired though formal education, training or specific experiences. Skills refer to developed capacities that facilitate learning or performance. Abilities are defined as underlying characteristics of individuals, which are related to effective or superior performance in a job.

The knowledge and skills measures are used in this analysis. It is important to remember that knowledge and skills in this study do not measure an individual worker's knowledge and skills. Instead, the knowledge and skills are measures of the average level required by the performance of certain functions in that occupation. Consequently, the score for one worker on any knowledge or skill may differ from another worker within the same occupation.

Occupational Employment Statistics (OES)

The Occupational Employment Statistics (OES) program conducts a yearly mail survey designed to produce estimates of employment and wages for specific occupations. The OES program collects data on wage and salary workers in non-farm establishments in order to produce employment and wage estimates for over 700 occupations. Data from self-employed persons are not collected and are not included in the estimates. The OES program produces these occupational estimates by geographic area and by industry. Estimates based on geographic areas are available at the national, state and metropolitan area levels. Occupational employment and wage estimates for over 400 industry classifications are also available.

The Missouri Department of Economic Development conducts the OES survey for the State of Missouri. Each year more than 10,000 employers will be surveyed through random selection based on their industrial classification, size and geographic location. In addition to the statewide data, there are tabulations for each of the state's six metropolitan statistical areas and thirteen Local Workforce Investment Areas.

Occupational Employment Projections

Occupational employment projections are developed using data from Missouri's occupational employment and wage survey along with unemployment insurance information provided by the State of Missouri and the U.S. Bureau of Labor Statistics. OES and Quarterly Census of Employment and Wages (QCEW) data are the basis for the occupational data used in the projections. The data collected reflect the Standard Occupational Classification (SOC). Many occupations are not identified separately in the SOC and are included in aggregate categories. Employment may not be sufficient to warrant the development of occupational projections in every occupation in each state, or the data may be confidential. The U.S. Employment and Training Administration provides funding for the employment projections program.

Mathematics-Intensive Occupations Summary

According to 2002 estimates, there were 19,710 mathematics-intensive jobs in Missouri earning an annual mean wage of $62,922 per job, which is much higher than the state average wage of $33,099. The projected number of mathematics-intensive jobs for 2012 is expected to increase by more than 22% to a total of 24,205 jobs. The average level of educational attainment for individuals employed in mathematics-intensive occupations in 2002 was a Bachelor's Degree or higher, plus work experience. In addition, workers in mathematics-intensive occupations accounted for 0.67% of all employment statewide.

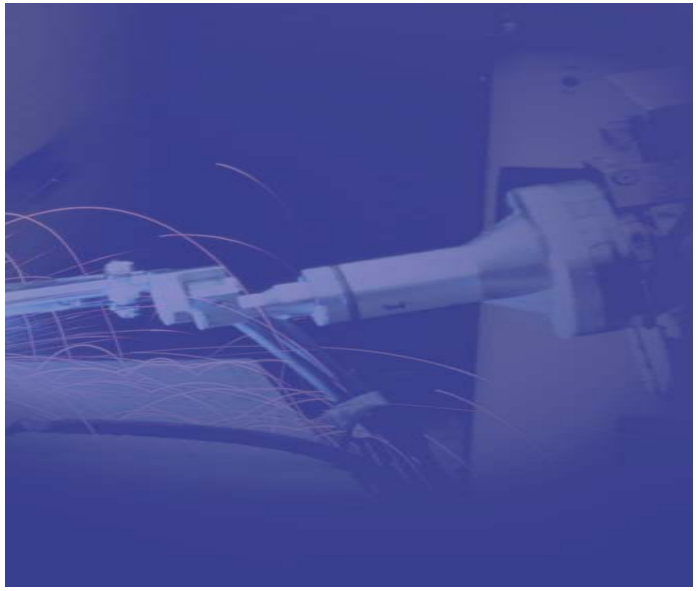
Most mathematics-intensive jobs were in Professional and Business Services, Information, Education and Health Services, Government, and Manufacturing. The projected net change of mathematics-intensive occupations from 2002 to 2012 is over 4,400 jobs. Nationally, there were 1.4 million mathematics-intensive jobs.

Mathematics-Intensive Occupations - Employment by Industry in Missouri			
Industry	**2002 Employment**	**2012 Employment**	**Net Change**
Construction	330	392	62
Education and Health Services	2,062	2,658	596
Financial Activities	1,237	1,534	297
Government	1,814	2,005	191
Information	3,437	4,657	1,220
Manufacturing	1,633	1,766	133
Natural Resources and Mining	82	72	-10
Other Services (Except Government)	144	182	38
Professional and Business Services	7,869	9,649	1,780
Self-Employed Workers, Primary Job	513	639	126
Trade, Transportation, and Utilities	589	651	62
Missouri Total	**19,710**	**24,205**	**4,495**
United States Total	**1,465,000**	**NA**	**NA**

Estimated annual average employment and wages for 2002. Number may not total due to rounding and survey averages.
NA: Number not calculated by the U.S. Bureau of Labor Statistics
Source: Analysis of Occupational Employment Statistics and O*NET by MERIC

In Missouri, mathematics-intensive occupations with the highest employment base were Computer Software Engineers, Applications (6,570 jobs at $68,320 per job); Civil Engineers (3,598 jobs at $60,000); Computer Software Engineers, Systems Software (3,284 jobs at $66,890 per job); Electronics Engineers (1,392 jobs at $64,810); and Mathematical Science Teachers, Higher Education (1,117 jobs at $48,170 per job).

Occupations with the largest percentage of national mean wages were Actuaries (106.38% of national mean wages), Hydrologists (104.67% of national mean wages), Surveyors (96.88% of national mean wages), Civil Engineers (95.22% of national mean wages), and Engineering Teachers, Higher Education (94.81% of national mean wages).



From 2002 to 2012, mathematics-intensive occupations with the largest projected percent increases in employment are:

- Computer Software Engineers, Systems Software (1,180 jobs at 35.87% change)
- Computer Software Engineers, Applications (2,081 jobs at 31.68% change)
- Mathematical Science Teachers, Higher Education (350 jobs at 31.34% change)
- Engineering Teachers, Higher Education (160 jobs at 29.79% change)
- Electronics Engineers (154 jobs at 11.06% change)

Mathematics-Intensive Occupations – Employment and Wages in Missouri and the United States

SOC	Occupation	Missouri					United States
		2002 Employment	2012 Employment	Entry Wage	Mean Wage	Expert Wage	Mean Wage
15-1031	Computer Software Engineers, Applications	6570	8651	$49,390	$68,320	$77,790	$73,800
17-2051	Civil Engineers	3598	3981	$43,070	$60,000	$68,460	$63,010
15-1032	Computer Software Engineers, Systems Software	3284	4464	$48,300	$66,890	$76,190	$75,840
17-2072	Electronics Engineers, Except Computer	1392	1546	$46,470	$64,810	$73,970	$71,600
25-1022	Mathematical Science Teachers, Higher Educ.	1117	1467	$29,870	$48,170	$57,330	$55,060
17-1022	Surveyors	720	783	$25,950	$41,300	$48,980	$42,630
15-2031	Operations Research Analysts	690	729	$34,500	$53,890	$63,590	$60,890
25-1032	Engineering Teachers, Higher Educ.	ND	ND	$39,070	$69,310	$84,430	$73,100
17-2061	Computer Hardware Engineers	316	335	$42,010	$60,910	$70,360	$76,150
15-2041	Statisticians	311	307	$30,280	$45,980	$53,830	$60,000
17-3021	Aerospace Engineering Technicians	ND	ND	ND	ND	ND	$52,990
15-2011	Actuaries	219	241	$47,410	$85,940	$105,210	$80,780
19-2042	Geoscientists	181	200	$31,300	$44,100	$50,500	$78,690
17-2021	Agricultural Engineers	ND	ND	ND	ND	ND	$55,730
17-2161	Nuclear Engineers	ND	ND	ND	ND	ND	$82,300
17-2151	Mining and Geological Engineers	ND	ND	ND	ND	ND	$64,770
19-2043	Hydrologists	75	83	$44,100	$61,570	$70,310	$58,820
17-2171	Petroleum Engineers	61	67	$38,690	$58,090	$67,790	$85,540
19-2012	Physicists	ND	ND	ND	ND	ND	$87,530
15-2021	Mathematicians	ND	ND	ND	ND	ND	$75,610
15-2091	Mathematical Technicians	ND	ND	ND	ND	ND	$42,920

Estimated annual average employment and wages for 2002. Projected annual average employment for 2012.
Source: Analysis of Occupational Employment Projections and Occupational Employment Statistics by MERIC.
ND: Non-disclosed data due to confidentiality restrictions from the U.S. Bureau of Labor Statistics.

Mathematics-Intensive Occupations – Missouri Percent of US Wages and Projected Employment Growth

SOC	Occupation	MO Employment 2002	MO Employment 2012	Total Growth Openings 2002-2012	MO Mean Wage	US Mean Wage	MO PCT of US Mean Wage
15-1031	Computer Software Engineers, Applications	6570	8651	2081	$68,320	$73,800	92.57
17-2051	Civil Engineers	3598	3981	383	$60,000	$63,010	95.22
15-1032	Computer Software Engineers, Software	3284	4464	1180	$66,890	$75,840	88.20
17-2072	Electronics Engineers, Except Computer	1392	1546	154	$64,810	$71,600	90.52
25-1022	Mathematical Science Teachers, Higher Educ.	1117	1467	350	$48,170	$55,060	87.49
17-1022	Surveyors	720	783	63	$41,300	$42,630	96.88
15-2031	Operations Research Analysts	690	729	39	$53,890	$60,890	88.50
25-1032	Engineering Teachers, Higher Educ.	ND	ND	160	$69,310	$73,100	94.82
17-2061	Computer Hardware Engineers	316	335	19	$60,910	$76,150	79.99
15-2041	Statisticians	311	307	0	$45,980	$60,000	76.63
17-3021	Aerospace Engineering Technicians	ND	ND	3	ND	$52,990	0.00
15-2011	Actuaries	219	241	22	$85,940	$80,780	106.39
19-2042	Geoscientists	181	200	19	$44,100	$78,690	56.04
17-2021	Agricultural Engineers	ND	ND	20	ND	$55,730	0.00
17-2161	Nuclear Engineers	ND	ND	0	ND	$82,300	0.00
17-2151	Mining and Geological Engineers	ND	ND	0	ND	$64,770	0.00
19-2043	Hydrologists	75	83	8	$61,570	$58,820	104.68
17-2171	Petroleum Engineers	61	67	6	$58,090	$85,540	67.91
19-2012	Physicists	ND	ND	0	ND	$87,530	0.00
15-2021	Mathematicians	ND	ND	0	ND	$75,610	0.00
15-2091	Mathematical Technicians	ND	ND	0	ND	$42,920	0.00

Estimated annual average employment and wages for 2002. Projected annual average employment for 2012.
Source: Analysis of Occupational Employment Projections and Occupational Employment Statistics by MERIC.
ND: Non-disclosed data due to confidentiality restrictions from the U.S. Bureau of Labor Statistics.

Using data from O*NET, skill proficiency scores were calculated by averaging the importance (IM) and level (LV) scores for each six-digit SOC occupation. IM and LV scores were then summed and standardized. The scores were standardized based on a 13 point scale, which is the result of summing both the 5 point importance scale and the 7 point level scale. This process generated a skills proficiency score that ranged from 0.0 (low skill proficiency) to 100.0 (high skill proficiency).

Skills refer to the developed capacities that facilitate learning and/or performance within occupations. Occupations with the highest mathematics skills proficiency were Mathematicians (score of 87.50), Mathematics Science Teachers, Higher Education (score of 86.08), Statisticians (score of 86.08), Physicists (score of 84.67), and Agricultural Engineers (score of 81.92).

"Today, with the emergence of the information age, the strength of a country is based on knowledge. National greatness will arise not from our natural resources or our factories, but from our people, people with new skills and ideas."

- Michael Milken,
Milken Institute

Mathematics-Intensive Occupations – Skills Proficiency

SOC	Occupation	Reading Comprehension	Active Listening	Writing	Speaking	Mathematics	Science	Critical Thinking	Active Learning	Learning Strategies	Monitoring
15-2021	Mathematicians	62.42	44.42	54.08	44.42	87.50	36.08	61.08	72.17	68.00	38.83
15-2041	Statisticians	72.17	55.50	65.17	55.50	86.08	66.58	79.08	76.33	63.83	62.50
25-1022	Mathematical Science Teachers, Higher Educ.	75.00	59.67	65.17	66.58	86.08	41.58	66.67	68.00	72.17	52.75
19-2012	Physicists	80.50	52.75	81.83	61.08	84.67	86.08	76.33	80.50	62.42	54.17
17-2021	Agricultural Engineers	72.17	63.83	66.58	69.42	81.92	81.92	76.33	77.75	62.42	62.42
17-2051	Civil Engineers	75.00	73.17	69.75	60.58	80.83	70.67	72.33	71.42	60.25	71.67
15-2011	Actuaries	69.42	41.58	58.25	47.17	79.17	27.75	70.83	66.58	40.25	65.25
17-1022	Surveyors	72.17	54.08	72.17	51.33	79.08	72.17	63.83	68.00	62.50	56.92
17-2151	Mining and Geological Engineers	74.25	61.75	72.92	62.42	79.08	77.75	75.67	77.00	54.08	66.67
25-1032	Engineering Teachers, Higher Educ.	77.67	63.83	66.58	69.42	79.08	73.58	73.58	74.92	69.33	56.83
15-2031	Operations Research Analysts	70.75	63.83	65.17	59.67	77.75	62.50	76.33	72.17	52.75	73.58
15-2091	Mathematical Technicians	66.58	65.17	52.75	56.83	77.67	56.92	70.83	62.42	49.92	55.50
19-2043	Hydrologists	66.58	36.08	72.17	41.58	77.67	76.33	74.92	72.17	37.50	43.00
17-2161	Nuclear Engineers	73.33	58.33	70.00	60.00	76.67	81.67	75.00	73.33	51.67	65.00
17-2171	Petroleum Engineers	66.67	58.33	70.00	61.67	76.67	68.33	66.67	58.33	38.33	55.00
15-1031	Computer Software Engineers, Applications	66.58	61.08	52.75	63.83	76.33	72.17	65.25	74.92	47.17	44.33
15-1032	Computer Software Engineers, Software	66.58	61.08	52.75	63.83	76.33	72.17	65.25	74.92	47.17	44.33
17-2061	Computer Hardware Engineers	66.58	61.08	52.75	63.83	76.33	72.17	65.25	74.92	47.17	44.33
19-2042	Geoscientists	68.00	43.00	69.42	49.92	76.33	72.17	69.42	69.42	31.83	44.42
17-2072	Electronics Engineers, Except Computer	73.33	53.33	68.33	56.67	75.00	68.33	66.67	58.33	41.67	45.00
17-3021	Aerospace Engineering Technicians	58.33	35.00	43.33	31.67	75.00	80.00	55.00	43.33	28.33	38.33

Skills proficiency reported on a 0.0 (low) to 100.0 (high) scale.
Source: Analysis of O*NET by MERIC

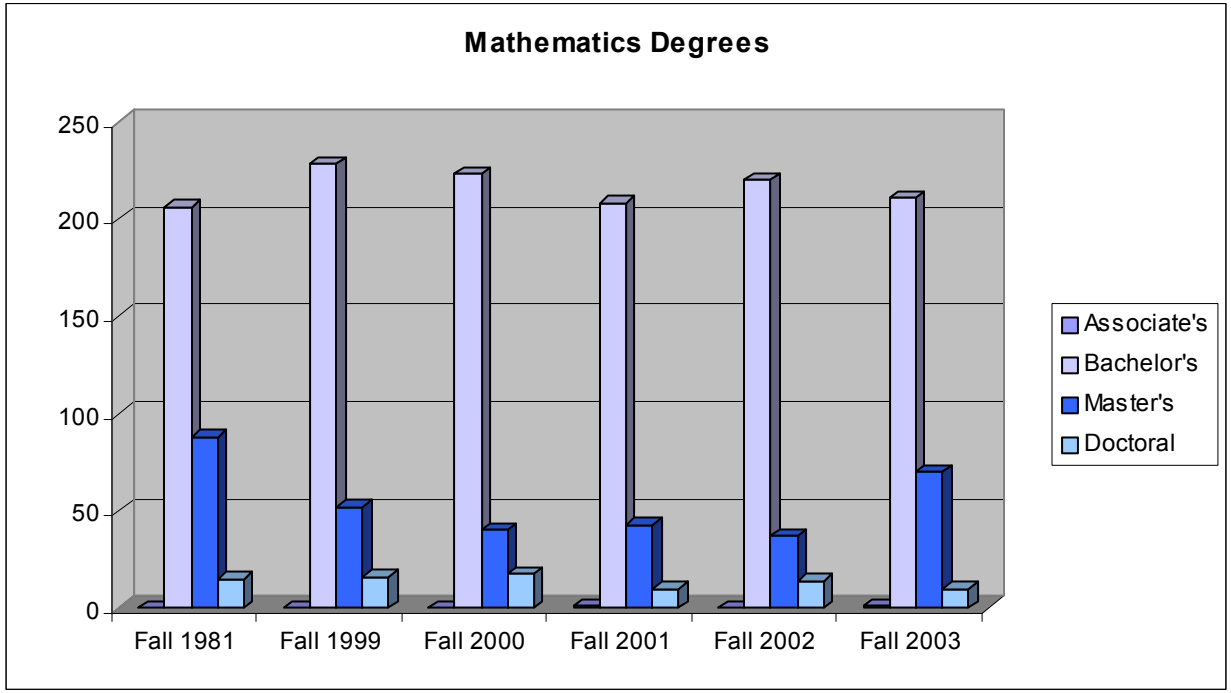
In the Fall of 2003, a total of 292 post secondary degrees in mathematics were conferred in Missouri, of which 72.3% were bachelor's degrees, 24% were master's degrees, and 3.4% were doctoral degrees. Although the number of bachelor's degrees in mathematics has increased slightly since the Fall of 1981, mathematics degrees as a percent of all bachelors degrees has significantly decreased over the same time period. This indicates that proportionately fewer graduates are obtaining bachelors degrees in mathematics in Missouri.

Since the Fall of 1981, the number of master's degrees in mathematics has significantly decreased, as has mathematics degrees as a percentage of all master's degrees. The number of doctoral degrees in mathematics has also decreased since the Fall of 1981, along with mathematics degrees as a percentage of doctoral degrees. This is a strong indicator that Missouri is producing far fewer graduates with advanced degrees in mathematics.

Mathematics
Degrees Conferred by Higher Education Institutions in Missouri

Degree	Fall 1981	Fall 1999	Fall 2000	Fall 2001	Fall 2002	Fall 2003
Associate's - Number	0	0	0	1	0	1
Associate's - % of All Degrees	0.00%	0.00%	0.00%	0.01%	0.00%	0.01%
Bachelor's - Number	206	228	223	208	220	211
Bachelor's - % of All Degrees	0.97%	0.82%	0.78%	0.73%	0.72%	0.67%
Master's - Number	88	52	40	43	37	70
Master's - % of All Degrees	1.20%	0.43%	0.32%	0.33%	0.28%	0.47%
Doctoral - Number	15	16	18	10	14	10
Doctoral - % of All Degrees	2.73%	2.37%	2.48%	1.32%	2.03%	1.25%

Includes public and private higher education institutions.
Source: Analysis of MO Department of Higher Education data by MERIC

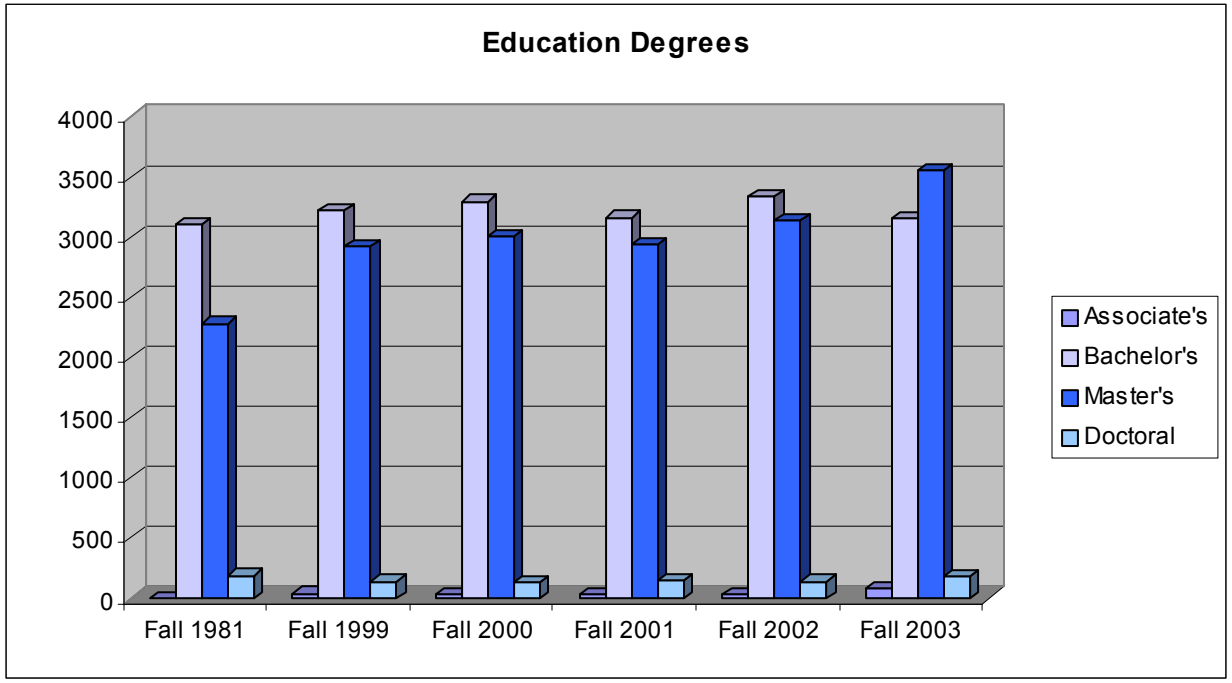


In the Fall of 2002, a total of 6,968 post secondary degrees in education were conferred in Missouri, of which 45.3% were bachelor's degrees, 51.1% were master's degrees, and 2.5% were doctoral degrees. The number of bachelor's degrees in education has slightly increased since the Fall of 1981, but the number of education degrees as a percentage of all bachelor's degrees has decreased significantly during that time period. This indicates that proportionally fewer graduates are obtaining bachelor's degrees in education in Missouri.

Since the Fall of 1981, the number of master's degrees in education has significantly increased, although the number of education degrees as a percentage of all master's degrees has decreased. In addition, the number and percent of doctoral degrees in education has declined since Fall of 1981. This indicates that Missouri is producing fewer graduates with advanced degrees in education.

Education
Degrees Conferred by Higher Education Institutions in Missouri

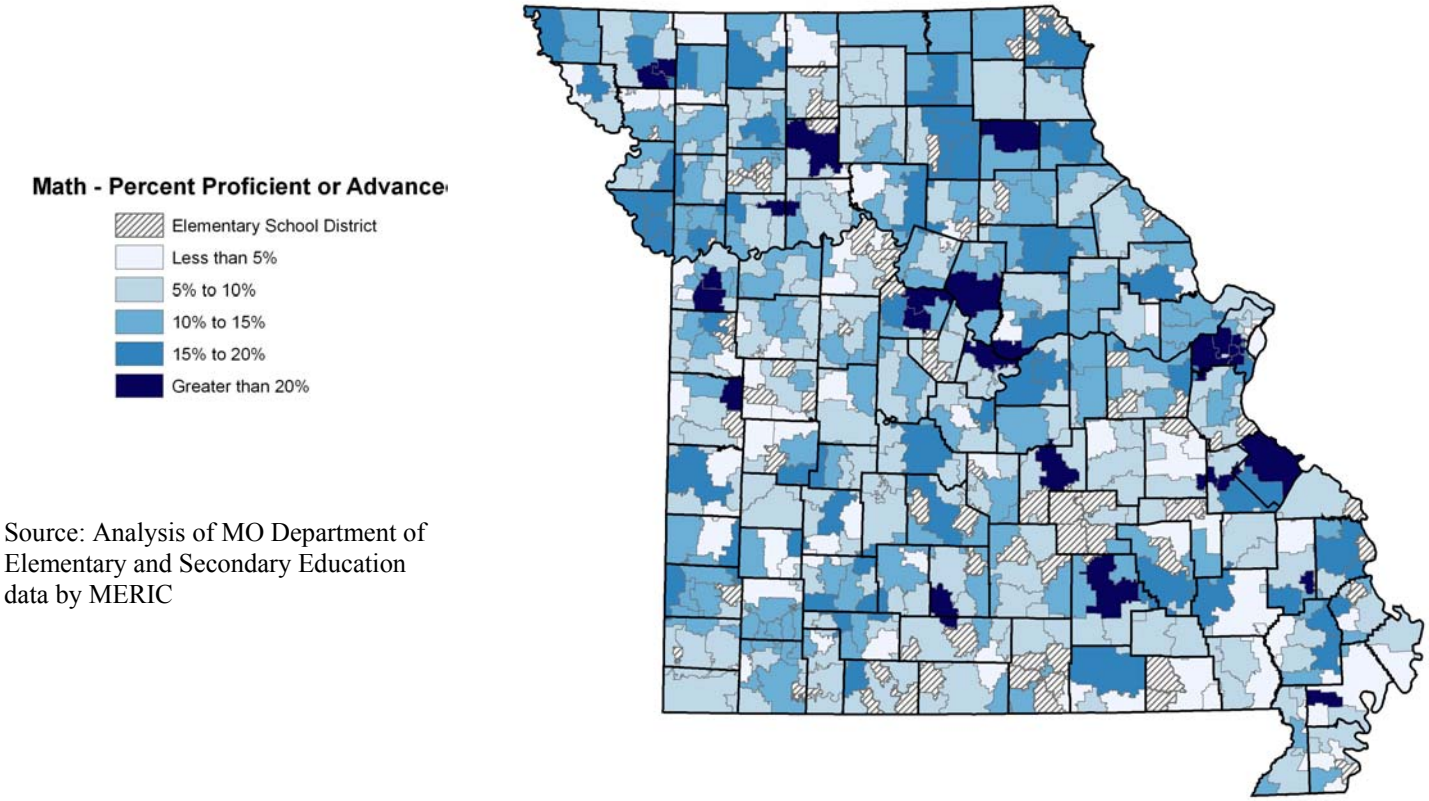
Degree	Fall 1981	Fall 1999	Fall 2000	Fall 2001	Fall 2002	Fall 2003
Associate's - Number	0	37	28	32	25	75
Associate's - % of All Degrees	0.00%	0.47%	0.35%	0.39%	0.30%	0.82%
Bachelor's - Number	3,101	3,224	3,297	3,162	3,343	3159
Bachelor's - % of All Degrees	14.67%	11.64%	11.51%	11.03%	11.00%	10.06%
Master's - Number	2,283	2,924	3,008	2,935	3,135	3,558
Master's - % of All Degrees	31.23%	24.11%	24.08%	22.78%	23.38%	23.79%
Doctoral - Number	185	137	134	145	137	176
Doctoral - % of All Degrees	33.70%	20.27%	18.46%	19.15%	19.83%	22.03%



Includes public and private higher education institutions.
Source: Analysis of MO Department of Higher Education data by MERIC

On average between 2000 and 2004, only 10.24% of Missouri's 10th graders were proficient or advanced in mathematics. Districts with the highest proficiencies were located in St. Louis County, suburban Kansas City, St. Genevieve County, Shannon County and pockets in north central, northwest, south central, central, west central, and southeast Missouri. Although the majority of the state's districts scored low on mathematics proficiency, many school districts have improved their proficiency scores since the 1997-2001 period.

Mathematics Missouri Assessment Program
Average Percent of 10th Grade Students Scoring Proficient or Advanced, 2000-2004



Source: Analysis of MO Department of Elementary and Secondary Education data by MERIC

Science-Intensive Occupations Summary

According to 2002 estimates, there were 41,010 science-intensive jobs in Missouri earning an annual mean wage of $79,618 per job, which is much higher than the state average wage of $33,099. The projected number of science-intensive jobs for 2012 is expected to increase by more than 19% to a total of 49,071 jobs. The average level of educational attainment for individuals employed in science-intensive occupations in 2002 was a Master's degree. In addition, workers in science-intensive occupations accounted for 1.40% of all employment statewide.

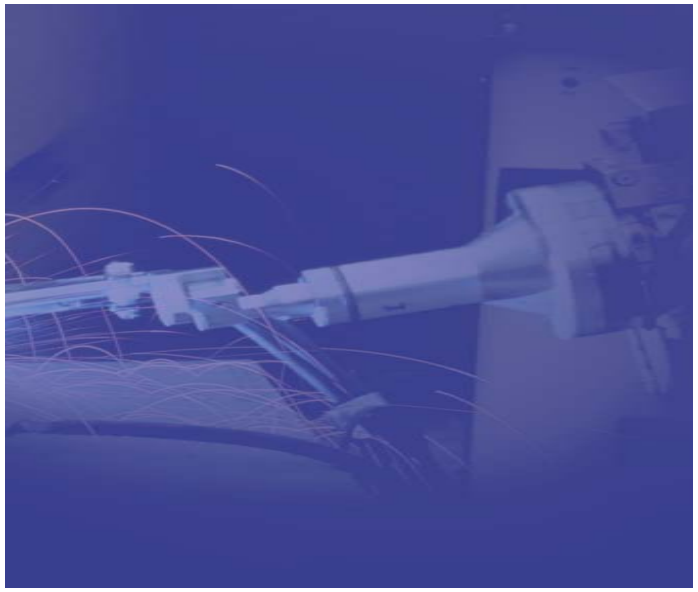
Most science-intensive jobs were in Education and Health Services, Professional and Business Services, Manufacturing, Government, Information, and Self-Employed Workers. The projected net change of science-intensive occupations from 2002 to 2012 is over 8,000 jobs. Nationally, there were 2.4 million science-intensive jobs.

Science-Intensive Occupations - Employment by Industry in Missouri			
Industry	**2002 Employment**	**2012 Employment**	**Net Change**
Construction	599	698	99
Education and Health Services	12,687	16,154	3,467
Financial Activities	921	1,177	256
Government	2,829	3,136	307
Information	2,601	3,787	1,186
Leisure and Hospitality	10	11	1
Manufacturing	6,647	6,818	171
Natural Resources and Mining	97	87	-10
Other Services (Except Government)	839	1,214	375
Professional and Business Services	10,644	12,850	2,206
Self-Employed Workers, Primary Job	2,221	2,146	-75
Trade, Transportation, and Utilities	915	993	78
Missouri Total	**41,010**	**49,071**	**8,061**
United States Total	**2,419,000**	**NA**	**NA**

Estimated annual average employment and wages for 2002. Number may not total due to rounding and survey averages.
NA: Number not calculated by the U.S. Bureau of Labor Statistics
Source: Analysis of Occupational Employment Statistics and O*NET by MERIC

In Missouri, science-intensive occupations with the highest employment base were Computer Software Engineers, Applications (6,570 jobs at $68,320 per job); Civil Engineers (3,598 jobs at $60,000); Family and General Practitioners (3,328 jobs at $131,910 per job); Computer Software Engineers, System Software (3,284 jobs at $66,890); and Mechanical Engineers (3,071 jobs at $61,090 per job).

Occupations with the largest percentage of national mean wages were Optometrists (159.7% of national mean wages), Atmospheric and Space Scientists (148.7% of national mean wages), Surveyors (140.9% of national mean wages), Hydrologists (139.7% of national mean wages), and Forensic Science Technicians (135.5% of national mean wages).



From 2002 to 2012, science-intensive occupations with the largest projected percent increases in employment are:

- Computer Software Engineers, System Software (1,180 jobs at 35.93% change)
- Health Specialties Teachers, Higher Education (962 jobs at 35.90% change)
- Chemistry Teachers, Higher Education (218 jobs at 31.91% change)
- Physics Teachers, Higher Education (115 jobs at 31.77% change)
- Computer Software Engineers, Applications (2,081 jobs at 31.67% change)

Science-Intensive Occupations – Employment and Wages in Missouri and the United States

SOC	Occupation	Missouri					United States
		Employment 2002	Employment 2012	Entry Wage	Mean Wage	Expert Wage	Mean Wage
15-1031	Computer Software Engineers, Applications	6570	8651	$49,390	$68,320	$77,790	$55,510
17-2051	Civil Engineers	3598	3981	$43,070	$60,000	$68,460	$48,360
29-1062	Family and General Practitioners	3328	3942	$65,310	$131,910	$165,210	$136,260
15-1032	Computer Software Engineers, Systems Software	3284	4464	$48,300	$66,890	$76,190	$58,500
17-2141	Mechanical Engineers	3071	3248	$43,030	$61,090	$70,130	$50,800
25-1071	Health Specialties Teachers, Higher Educ.	ND	ND	$35,300	$55,600	$65,740	$72,820
17-2011	Aerospace Engineers	ND	ND	ND	ND	ND	$59,520
29-1067	Surgeons	1319	1591	$189,450	$203,240	$210,140	$189,590
19-2031	Chemists	1235	1347	$32,070	$51,680	$61,490	$39,410
29-1131	Veterinarians	1150	1225	$35,240	$57,410	$68,490	$49,050
19-1042	Medical Scientists, Except Epidemiologists	ND	ND	ND	ND	ND	$40,180
29-1063	Internists, General	1022	1205	$102,460	$164,330	$195,270	$158,350
17-2041	Chemical Engineers	867	943	$52,420	$76,940	$89,200	$58,320
25-1042	Biological Science Teachers, Higher Educ.	845	1106	$31,350	$49,040	$57,890	$67,750
29-1065	Pediatricians, General	759	866	$97,080	$165,820	$200,190	$142,360
11-9121	Natural Sciences Managers	753	812	$49,650	$80,680	$96,190	$60,000
17-1022	Surveyors	720	783	$25,950	$41,300	$48,980	$29,320
25-1052	Chemistry Teachers, Higher Educ.	683	901	$38,470	$54,470	$62,470	$60,800
29-1041	Optometrists	591	652	$58,650	$99,060	$119,260	$62,030
29-1066	Psychiatrists	591	705	$80,440	$136,700	$164,820	$135,220
29-1064	Obstetricians and Gynecologists	548	656	$166,050	$194,790	$209,160	$179,640

Science-Intensive Occupations – Employment and Wages in Missouri and the United States (cont.)

SOC	Occupation	Missouri					United States
		Employment 2002	Employment 2012	Entry Wage	Mean Wage	Expert Wage	Mean Wage
25-1032	Engineering Teachers, Higher Educ.	ND	ND	$39,070	$69,310	$84,430	$73,100
25-1041	Agricultural Sciences Teachers, Higher Educ.	487	627	$36,460	$62,540	$75,580	$67,660
25-1054	Physics Teachers, Higher Educ.	362	477	$35,120	$54,800	$64,640	$66,960
17-2061	Computer Hardware Engineers	316	335	$42,010	$60,910	$70,360	$56,490
19-1021	Biochemists and Biophysicists	ND	ND	ND	ND	ND	$43,110
17-3021	Aerospace Engineering and Operations Technicians	ND	ND	ND	ND	ND	$42,740
19-4092	Forensic Science Technicians	ND	ND	$30,550	$42,840	$48,990	$31,620
19-2021	Atmospheric and Space Scientists	200	195	$30,590	$59,440	$73,870	$39,970
19-1022	Microbiologists	187	213	$32,170	$49,750	$58,530	$39,100
19-2042	Geoscientists, Except Hydrologists and Geographers	181	200	$31,300	$44,100	$50,500	$48,370
17-2021	Agricultural Engineers	ND	ND	ND	ND	ND	$40,320
17-2161	Nuclear Engineers	ND	ND	ND	ND	ND	$67,970
17-2151	Mining and Geological Engineers, Mining Safety	ND	ND	ND	ND	ND	$48,250
19-2043	Hydrologists	75	83	$44,100	$61,570	$70,310	$44,080
19-1023	Zoologists and Wildlife Biologists	ND	ND	ND	ND	ND	$37,100
25-1043	Forestry and Conservation Sci. Teachers, Higher Educ.	ND	ND	ND	ND	ND	$68,030
19-2012	Physicists	ND	ND	ND	ND	ND	$66,680
19-2032	Materials Scientists	23	25	$30,450	$62,540	$78,580	$46,280
19-1041	Epidemiologists	ND	ND	ND	ND	ND	$44,900

Estimated annual average employment and wages for 2002. Projected annual average employment for 2012.
Source: Analysis of Occupational Employment Projections and Occupational Employment Statistics by MERIC.
ND: Non-disclosed data due to confidentiality restrictions from the U.S. Bureau of Labor Statistics.

Science-Intensive Occupations – Missouri Percent of US Wages and Projected Employment Growth

SOC	Occupation	MO Employment 2002	MO Employment 2012	Total Growth Openings 2002-2012	MO Mean Wage	US Mean Wage	MO PCT of US Mean Wage
15-1031	Computer Software Engineers, Applications	6570	8651	2081	$68,320	$55,510	123.08
17-2051	Civil Engineers	3598	3981	383	$60,000	$48,360	124.07
29-1062	Family and General Practitioners	3328	3942	614	$131,910	$136,260	96.81
15-1032	Computer Software Engineers, Systems Software	3284	4464	1180	$66,890	$58,500	114.34
17-2141	Mechanical Engineers	3071	3248	177	$61,090	$50,800	120.26
25-1071	Health Specialties Teachers, Higher Educ.	ND	ND	962	$55,600	$72,820	76.35
17-2011	Aerospace Engineers	ND	ND	0	ND	$59,520	0.00
29-1067	Surgeons	1319	1591	272	$203,240	$189,590	107.20
19-2031	Chemists	1235	1347	112	$51,680	$39,410	131.13
29-1131	Veterinarians	1150	1225	75	$57,410	$49,050	117.04
19-1042	Medical Scientists, Except Epidemiologists	ND	ND	320	ND	$40,180	0.00
29-1063	Internists, General	1022	1205	183	$164,330	$158,350	103.78
17-2041	Chemical Engineers	867	943	76	$76,940	$58,320	131.93
25-1042	Biological Science Teachers, Higher Educ.	845	1106	261	$49,040	$67,750	72.38
29-1065	Pediatricians, General	759	866	107	$165,820	$142,360	116.48
11-9121	Natural Sciences Managers	753	812	59	$80,680	$60,000	134.47
17-1022	Surveyors	720	783	63	$41,300	$29,320	140.86
25-1052	Chemistry Teachers, Higher Educ.	683	901	218	$54,470	$60,800	89.59

Science-Intensive Occupations – Missouri Percent of US Wages and Projected Employment Growth (cont.)

SOC	Occupation	MO Employment 2002	MO Employment 2012	Total Growth Openings 2002-2012	MO Mean Wage	US Mean Wage	MO PCT of US Mean Wage
29-1041	Optometrists	591	652	61	$99,060	$62,030	159.70
29-1066	Psychiatrists	591	705	114	$136,700	$135,220	101.09
29-1064	Obstetricians and Gynecologists	548	656	108	$194,790	$179,640	108.43
25-1032	Engineering Teachers, Higher Educ.	ND	ND	160	$69,310	$73,100	94.82
25-1041	Agricultural Sciences Teachers, Higher Educ.	487	627	140	$62,540	$67,660	92.43
25-1054	Physics Teachers, Higher Educ.	362	477	115	$54,800	$66,960	81.84
17-2061	Computer Hardware Engineers	316	335	19	$60,910	$56,490	107.82
19-1021	Biochemists and Biophysicists	ND	ND	86	ND	$43,110	0.00
17-3021	Aerospace Engineering and Operations Technicians	ND	ND	3	ND	$42,740	0.00
19-4092	Forensic Science Technicians	ND	ND	48	$42,840	$31,620	135.48
19-2021	Atmospheric and Space Scientists	200	195	0	$59,440	$39,970	148.71
19-1022	Microbiologists	187	213	26	$49,750	$39,100	127.24
19-2042	Geoscientists, Except Hydrologists and Geographers	181	200	19	$44,100	$48,370	91.17
17-2021	Agricultural Engineers	ND	ND	20	ND	$40,320	0.00
17-2161	Nuclear Engineers	ND	ND	0	ND	$67,970	0.00
17-2151	Mining and Geological Engineers, Mining Safety	ND	ND	0	ND	$48,250	0.00
19-2043	Hydrologists	75	83	8	$61,570	$44,080	139.68
19-1023	Zoologists and Wildlife Biologists	ND	ND	0	ND	$37,100	0.00
25-1043	Forestry and Conservation Sci. Teachers, Higher Edu	ND	ND	8	ND	$68,030	0.00
19-2012	Physicists	ND	ND	0	ND	$66,680	0.00
19-2032	Materials Scientists	23	25	2	$62,540	$46,280	135.13
19-1041	Epidemiologists	ND	ND	5	ND	$44,900	0.00

Estimated annual average employment and wages for 2002. Projected annual average employment for 2012. Entry wages represent the 25th percentile and expert wages represent the 75th percentile. Source: Analysis of Occupational Employment Projections and Occupational Employment Statistics by MERIC.

Using data from O*NET, skill proficiency scores were calculated by averaging the importance (IM) and level (LV) scores for each six-digit SOC occupation. IM and LV scores were then summed and standardized. The scores were standardized based on a 13 point scale, which is the result of summing both the 5 point importance scale and the 7 point level scale. This process generated a skills proficiency score that ranged from 0.0 (low skill proficiency) to 100.0 (high skill proficiency).

Skills refer to the developed capacities that facilitate learning and/or performance within occupations. Occupations with the highest science skills proficiency were Physicists (score of 86.08), Chemical Engineers (score of 86.08), Biochemists and Biophysicists (score of 84.17), Agricultural Engineers (score of 81.92), and Nuclear Engineers (score of 81.67).

Science-Intensive Occupations – Skills Proficiency

SOC	Occupation	Reading Comprehension	Active Listening	Writing	Speaking	Mathematics	Science	Critical Thinking	Active Learning	Learning Strategies	Monitoring
19-2012	Physicists	80.50	52.75	81.83	61.08	84.67	86.08	76.33	80.50	62.42	54.17
17-2041	Chemical Engineers	79.08	48.58	62.50	63.83	70.83	86.08	76.33	79.08	38.83	68.00
19-1021	Biochemists and Biophysicists	75.00	31.67	68.33	32.50	67.50	84.17	64.17	65.83	34.17	44.17
17-2021	Agricultural Engineers	72.17	63.83	66.58	69.42	81.92	81.92	76.33	77.75	62.42	62.42
17-2161	Nuclear Engineers	73.33	58.33	70.00	60.00	76.67	81.67	75.00	73.33	51.67	65.00
25-1071	Health Specialties Teachers, Higher Educ.	83.25	68.00	79.08	69.42	51.33	80.50	70.75	70.75	62.42	63.83
17-3021	Aerospace Engineering Technicians	58.33	35.00	43.33	31.67	75.00	80.00	55.00	43.33	28.33	38.33
19-1022	Microbiologists	73.33	31.67	73.33	28.33	53.33	80.00	53.33	55.00	36.67	40.00
29-1131	Veterinarians	81.92	68.00	65.25	70.83	56.92	79.17	77.75	77.67	69.33	70.75
19-1041	Epidemiologists	81.83	63.83	77.75	70.75	72.17	79.08	77.75	86.08	72.17	62.50
19-1042	Medical Scientists, Except Epidemiologists	81.83	63.83	77.75	70.75	72.17	79.08	77.75	86.08	72.17	62.50
25-1054	Physics Teachers, Higher Educ.	83.33	66.58	81.92	74.92	72.17	79.08	74.92	73.58	74.92	62.42
19-2032	Materials Scientists	65.25	40.25	70.83	52.67	63.83	79.08	48.50	65.25	41.67	38.83
17-2151	Mining and Geological Engineers	74.25	61.75	72.92	62.42	79.08	77.75	75.67	77.00	54.08	66.67
19-1020	Biological Scientists	81.42	73.17	66.00	53.50	57.08	76.67	74.25	73.08	46.08	51.08
19-1013	Soil and Plant Scientists	68.75	41.63	65.21	55.54	55.46	76.38	68.00	62.46	31.21	39.54
19-2043	Hydrologists	66.58	36.08	72.17	41.58	77.67	76.33	74.92	72.17	37.50	43.00
19-2021	Atmospheric and Space Scientists	72.17	52.67	62.42	70.83	63.83	76.33	73.50	73.58	59.67	56.92
19-1011	Animal Scientists	70.75	37.42	59.67	41.67	61.08	76.33	70.75	72.17	41.58	54.17
19-1012	Food Scientists and Technologists	62.42	51.33	49.92	44.42	56.83	76.33	61.08	68.00	31.92	40.17
19-1023	Zoologists and Wildlife Biologists	76.00	71.50	76.17	62.50	59.75	75.58	67.75	69.67	59.67	64.75

Science-Intensive Occupations – Skills Proficiency (cont.)

SOC	Occupation	Reading Comprehension	Active Listening	Writing	Speaking	Mathematics	Science	Critical Thinking	Active Learning	Learning Strategies	Monitoring
19-2031	Chemists	75.42	67.75	68.25	67.08	66.00	75.25	67.92	69.83	58.92	66.33
25-1052	Chemistry Teachers, Higher Educ.	81.92	65.25	81.92	76.33	72.17	74.92	72.17	75.00	76.33	63.83
19-4092	Forensic Science Technicians	71.83	65.83	63.25	74.42	55.83	73.83	68.00	68.83	59.67	64.92
25-1032	Engineering Teachers, Higher Educ.	77.67	63.83	66.58	69.42	79.08	73.58	73.58	74.92	69.33	56.83
29-1062	Family and General Practitioners	81.67	66.67	63.33	66.67	63.33	73.33	66.67	70.00	50.00	63.33
29-1063	Internists, General	81.67	66.67	63.33	66.67	63.33	73.33	66.67	70.00	50.00	63.33
29-1064	Obstetricians and Gynecologists	81.67	66.67	63.33	66.67	63.33	73.33	66.67	70.00	50.00	63.33
29-1065	Pediatricians, General	81.67	66.67	63.33	66.67	63.33	73.33	66.67	70.00	50.00	63.33
17-2011	Aerospace Engineers	78.42	74.75	74.42	72.83	64.00	73.17	82.08	77.33	59.17	73.92
17-2141	Mechanical Engineers	73.42	68.58	66.25	64.75	74.83	73.08	70.58	66.25	42.00	65.75
17-1022	Surveyors	72.17	54.08	72.17	51.33	79.08	72.17	63.83	68.00	62.50	56.92
15-1031	Computer Software Engineers, Applications	66.58	61.08	52.75	63.83	76.33	72.17	65.25	74.92	47.17	44.33
15-1032	Computer Software Engineers, Systems Software	66.58	61.08	52.75	63.83	76.33	72.17	65.25	74.92	47.17	44.33
17-2061	Computer Hardware Engineers	66.58	61.08	52.75	63.83	76.33	72.17	65.25	74.92	47.17	44.33
19-2042	Geoscientists	68.00	43.00	69.42	49.92	76.33	72.17	69.42	69.42	31.83	44.42
25-1041	Agricultural Sciences Teachers, Higher Educ.	79.08	62.42	70.75	70.83	63.83	72.17	70.75	72.17	70.83	59.67
25-1042	Biological Science Teachers, Higher Educ.	79.08	62.42	70.75	70.83	63.83	72.17	70.75	72.17	70.83	59.67
25-1043	Conservation Science Teachers, Higher Educ.	79.08	62.42	70.75	70.83	63.83	72.17	70.75	72.17	70.83	59.67
11-9121	Natural Sciences Managers	77.67	62.42	68.00	69.42	61.00	72.17	73.58	70.75	45.75	68.00
29-1066	Psychiatrists	78.75	88.67	70.50	74.92	27.25	71.83	85.00	87.58	74.75	76.67
29-1067	Surgeons	78.33	65.00	63.33	60.00	50.00	71.67	71.67	61.67	40.00	61.67
17-2051	Civil Engineers	75.00	73.17	69.75	60.58	80.83	70.67	72.33	71.42	60.25	71.67
29-1041	Optometrists	80.58	81.17	58.50	67.25	62.83	70.42	76.58	71.92	62.17	64.08

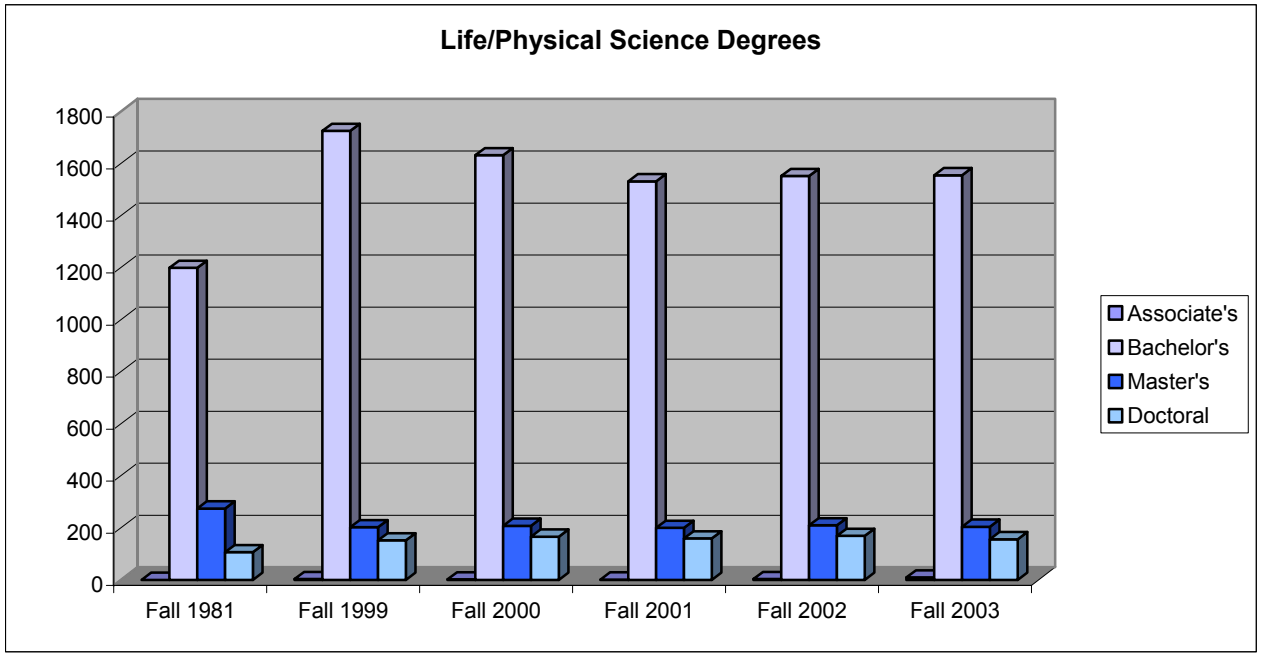
Skills proficiency reported on a 0.0 (low) to 100.0 (high) scale.
Source: Analysis of O*NET by MERIC

In the Fall of 2003, a total of 1,924 post secondary degrees in life/physical science were conferred in Missouri, of which 80.8% were bachelor's degrees, 10.6% were master's degrees, and 8.1% were doctoral degrees. Although the number of bachelor's degrees in life/physical science has increased since the Fall of 1981, science degrees as a percent of all bachelors degrees has decreased over the same time period. This indicates that proportionately fewer graduates are obtaining bachelors degrees in life/physical science in Missouri.

Since the Fall of 1981, the number of master's degrees in life/physical science has decreased as has life/physical science degrees as a percentage of all master's degrees. The number of doctoral degrees in life/physical science has increased since the Fall of 1981, along with life/physical science degrees as a percentage of doctoral degrees. This is an indicator that, overall Missouri is producing fewer graduates with advanced degrees in life/physical science.

Life/Physical Science
Degrees Conferred by Higher Education Institutions in Missouri

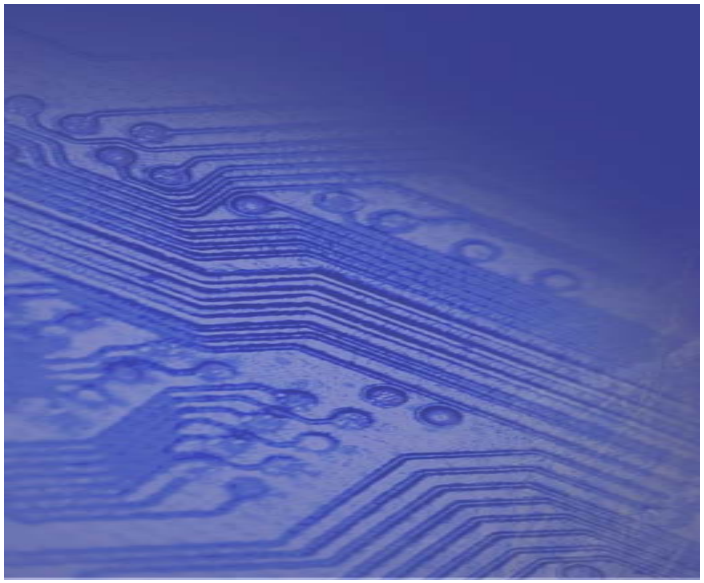
Degree	Fall 1981	Fall 1999	Fall 2000	Fall 2001	Fall 2002	Fall 2003
Associate's - Number	0	3	2	1	3	9
Associate's - % of All Degrees	0.00%	0.04%	0.02%	0.01%	0.04%	0.10%
Bachelor's - Number	1199	1726	1632	1532	1552	1555
Bachelor's - % of All Degrees	5.67%	6.23%	5.70%	5.35%	5.11%	4.95%
Master's - Number	274	202	208	200	210	204
Master's - % of All Degrees	3.75%	1.67%	1.66%	1.55%	1.57%	1.36%
Doctoral - Number	106	152	166	159	169	156
Doctoral - % of All Degrees	19.31%	22.49%	22.87%	21.00%	24.46%	19.52%



Includes public and private higher education institutions.
Source: Analysis of MO Department of Higher Education data by MERIC

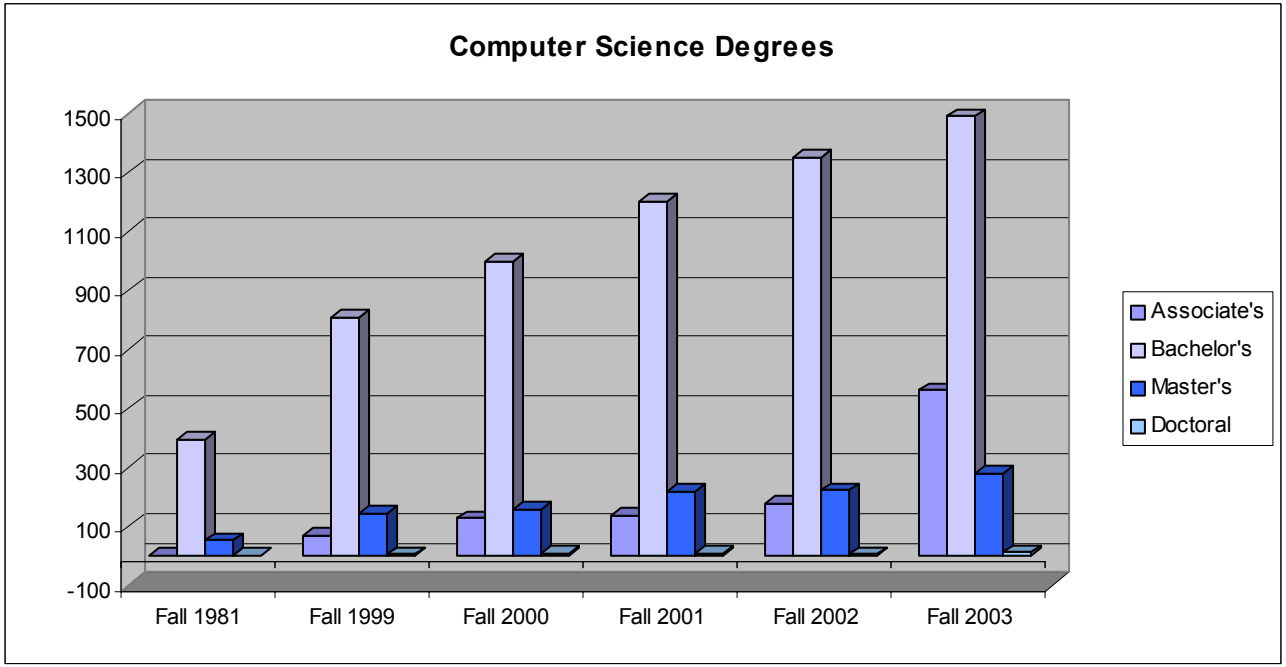
In the Fall of 2002, a total of 2,344 post secondary degrees in computer science were conferred in Missouri, of which 63.6% were bachelor's degrees, 11.9% were master's degrees, and 0.47% were doctoral degrees. The number of bachelor's degrees in computer science has significantly increased since the Fall of 1981, and the number of computer science degrees as a percentage of all bachelor's degrees has also increased significantly during that time period. This indicates that proportionally more graduates are obtaining bachelor's degrees in computer science in Missouri.

Since the Fall of 1981, the number of master's degrees in computer science has significantly increased, and the number of computer science degrees as a percentage of all master's degrees has likewise increased. In addition, the number and percent of doctoral degrees in computer science has increased since Fall of 1981. This indicates that Missouri is producing more graduates with advanced degrees in computer science.



Computer Science
Degrees Conferred by Higher Education Institutions in Missouri

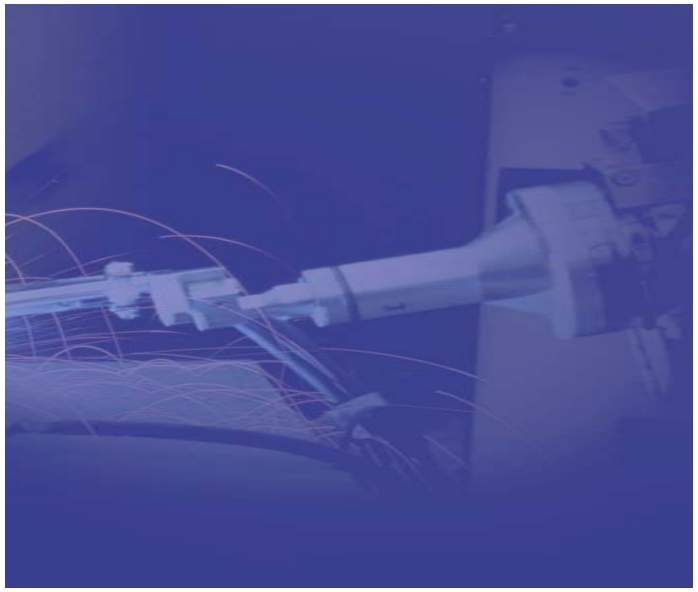
Degree	Fall 1981	Fall 1999	Fall 2000	Fall 2001	Fall 2002	Fall 2003
Associate's - Number	0	69	126	139	176	561
Associate's - % of All Degrees	0.00%	0.87%	1.57%	1.69%	2.08%	6.17%
Bachelor's - Number	396	809	998	1,203	1,349	1491
Bachelor's - % of All Degrees	1.87%	2.92%	3.48%	4.20%	4.44%	4.75%
Master's - Number	53	142	159	220	223	281
Master's - % of All Degrees	0.73%	1.17%	1.27%	1.71%	1.66%	1.88%
Doctoral - Number	3	6	8	7	4	11
Doctoral - % of All Degrees	0.55%	0.89%	1.10%	0.92%	0.58%	1.38%



Includes public and private higher education institutions.
Source: Analysis of MO Department of Higher Education data by MERIC

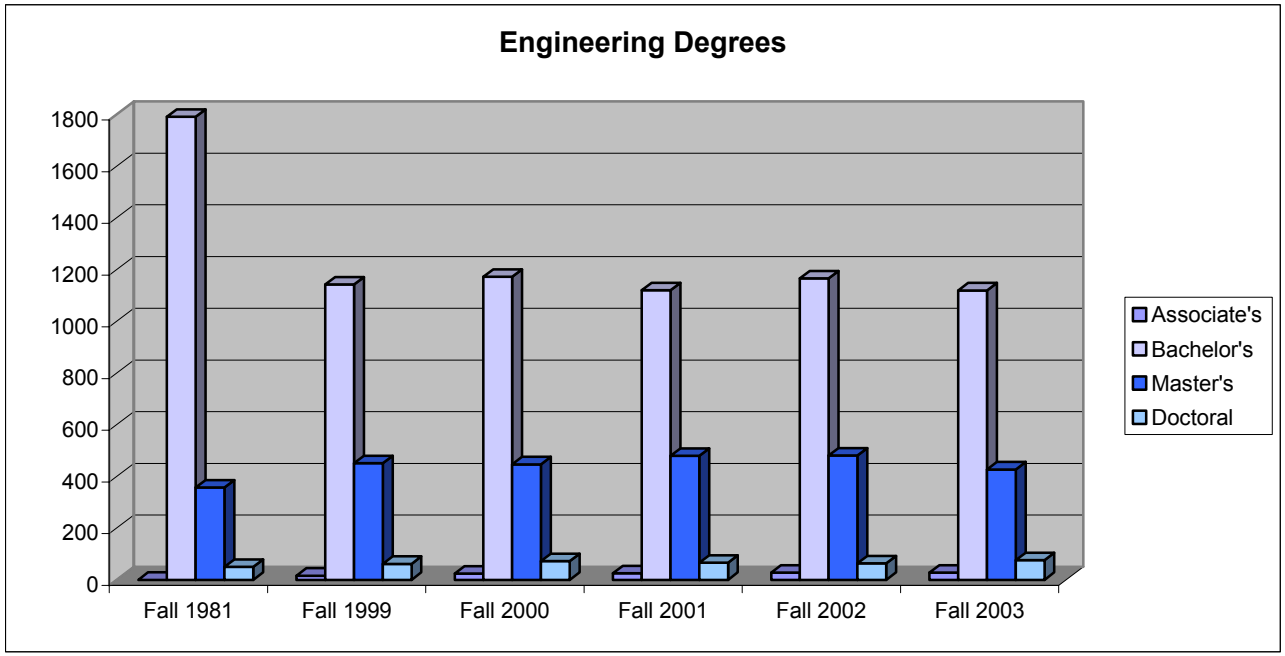
In the Fall of 2002, a total of 1,650 post secondary degrees in engineering were conferred in Missouri, of which 67.8% were bachelor's degrees, 25.9% were master's degrees, and 4.6% were doctoral degrees. The number of bachelor's degrees in engineering has significantly decreased since the Fall of 1981, and the number of engineering degrees as a percentage of all bachelor's degrees has also decreased significantly during that time period. This indicates that proportionally fewer graduates are obtaining bachelor's degrees in engineering in Missouri.

Since the Fall of 1981, the number of master's degrees in engineering has significantly increased, while the number of engineering degrees as a percentage of all master's degrees has decreased. In addition, the number and percent of doctoral degrees in engineering have increased since Fall of 1981. This indicates that Missouri is producing fewer graduates with bachelor's degrees in engineering while producing more master's and doctoral degrees.



Engineering
Degrees Conferred by Higher Education Institutions in Missouri

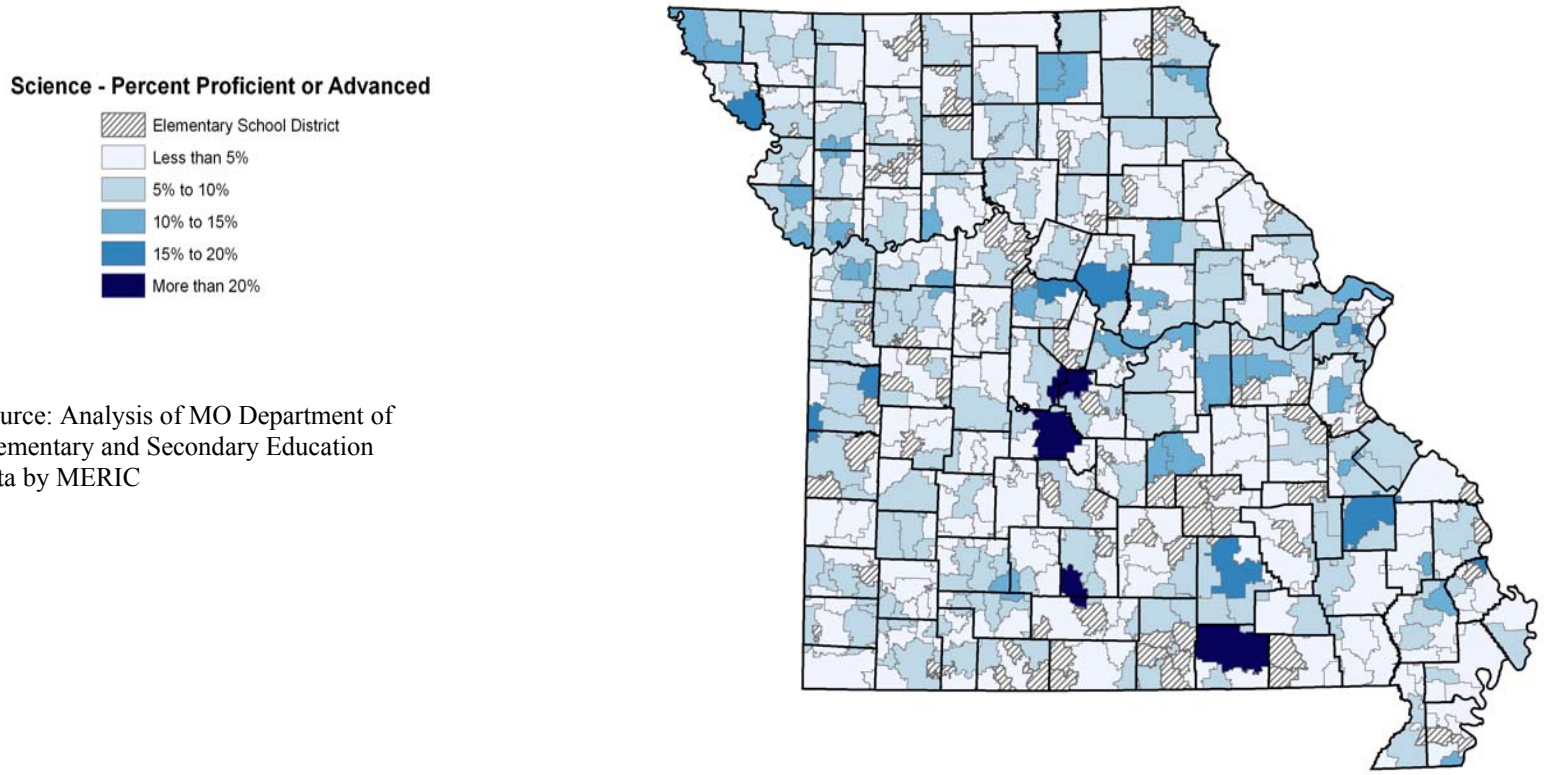
Degree	Fall 1981	Fall 1999	Fall 2000	Fall 2001	Fall 2002	Fall 2003
Associate's - Number	0	16	24	25	28	28
Associate's - % of All Degrees	0.00%	0.20%	0.30%	0.30%	0.33%	0.31%
Bachelor's - Number	1,791	1,142	1,172	1,120	1,166	1119
Bachelor's - % of All Degrees	8.47%	4.12%	4.09%	3.91%	3.84%	3.56%
Master's - Number	357	451	447	480	481	427
Master's - % of All Degrees	4.88%	3.72%	3.58%	3.73%	3.59%	2.86%
Doctoral - Number	50	62	72	66	64	76
Doctoral - % of All Degrees	9.11%	9.17%	9.92%	8.72%	9.26%	9.51%



Includes public and private higher education institutions.
Source: Analysis of MO Department of Higher Education data by MERIC

On average between 2000 and 2004, only 5.54% of Missouri's 10th graders were proficient or advanced in science. Districts with the highest proficiencies were located in Oregon, Wright, Morgan, Miller, and Camden Counties. Although the majority of the state's districts scored low on science proficiency, many school districts have improved their proficiency scores since the 1997-2001 period.

Science Missouri Assessment Program
Average Percent of 10th Grade Students Scoring Proficient or Advanced, 2000-2004



Source: Analysis of MO Department of Elementary and Secondary Education data by MERIC

Implications & Summary

State and national economic growth are directly tied to innovation.[6] To remain competitive in a global market over the long-term, states must focus on educating their current and future workforce in science and mathematics to align worker skills with the needs of innovative businesses. This report focused on the need to provide training and education to meet the needs of innovative or high-tech industries in Missouri. Occupations that require a high degree of knowledge in mathematics and science were analyzed – two skills that have, in the past, been linked to occupations with job security, advancement, and high wages.

According to 2002 estimates, there were 19,710 mathematics-intensive (annual mean wage $62,922) and 41,010 science-intensive jobs (annual mean wage $79,618) in Missouri, which all paid much higher salaries than the state average wage of $33,099 per job. Furthermore, workers in mathematics-intensive occupations accounted for 0.67% of all employment statewide with workers in science-intensive occupations accounting for 1.40%. In general, mean annual wages per job for most mathematics-intensive occupations were below the national averages. However, mean annual wages per job for many of the science-intensive occupations in Missouri were above the national average. Most mathematics-intensive jobs were in Professional and Business Services (7,869 jobs), Information (3,437 jobs), Education and Health Services (2,062 jobs), Government (1,814 jobs), and Manufacturing (1,633 jobs). There is a projected net change of over 4,400 mathematics-intensive jobs from 2002 to 2012 in Missouri. Most science-intensive jobs were in Education and Health Services (12,687), Professional and Business Services (10,644), Manufacturing (6,647), Government (2,829), Information (2,601), and Self-Employed Workers (2,221). There is a projected net change of over 8,000 science-intensive jobs from 2002 to 2012 in Missouri.

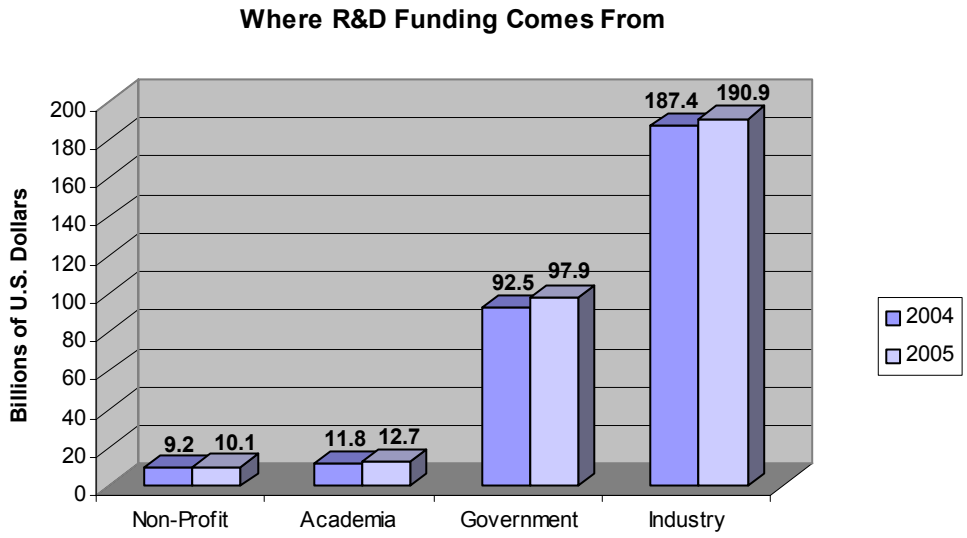
It is troubling that Missouri institutions of higher education are producing fewer college graduates in science and mathematics-related fields than they did 20 years ago. The number of graduates obtaining any post-secondary degree (bachelor's, master's, or doctorate) in mathematics, education, life/physical science, and engineering has been steadily decreasing. The exception to this declining trend is in computer sciences, where the number of graduates attaining post-secondary degrees has significantly increased. These low numbers in post secondary mathematics and science degree attainment are troubling in that the numbers indicate Missouri's labor pool may foster a potential shortage of skilled high-tech labor.[7] Likewise, our decreasing levels of Ph.D. degree holders may significantly affect Missouri's ability to have quality research and development centers and a solidly advanced elementary education system.

Of greatest concern is the fact that only 10.24% of Missouri's 10th graders were proficient or advanced in mathematics and only 5.54% were proficient or advanced in science. This is a strong indicator that Missouri's K-12 student population is ill-equipped for post-secondary education in math or science-related subjects, and ill-equipped to immediately work after high school in occupations that require mathematics and science-related skills. These numbers also reflect a possible issue with the strength and effectiveness of Missouri's mathematics and science curriculum.

Because Missouri is not producing adequate numbers of high school students who are fully prepared for mathematics or science studies in college and that our state is producing fewer post-secondary degrees in these fields, high-tech employers in the state will most likely look elsewhere in the nation or the world in order to meet their employment needs. According to the U.S. National Science Foundation,

> "In 1999, one-third of all high tech PhD-holders working in industry were born abroad. Among computer scientists, the proportion was half, and among engineers it was more than half. For the Federal Government workforce, 16 percent of PhD holders in 1999 were born abroad."[8]

Recent trends in industrial high-tech employment in the U.S. seem to indicate that many companies are already having to move some of their research and development activities to countries like China and India to meet their need for innovation.[9] Because industry is responsible for more than 61% of total research and development spending in the U.S., this trend of using offshore labor pools to meet the high-tech needs of business spells trouble for our nation's ability to continue to produce high-tech workers and lead the world in innovation.



Source: R&D Magazine, Battelle

References

[1] DeVol, R. & Koepp, R. *State Technology and Science Index: Enduring Lessons for the Intangible Economy*. Milken Institute, March 2004. pp.1-68.

[2] Feldman, M. & Florida, R. The Geographic Source of Innovation: Technological Infrastructure and Product Innovation in the United States. Annals of the Association of American Geographers, 84(2), 1994, pp.210-229.

[3] Schumpeter, Joseph. *Capitalism, Socialism, and Democracy*. 1954. 3rd ed. New York: Harper and Row.

[4] NGA Center for Best Practices, 2004 Issue Brief *"Enhancing Competitiveness: A Review of Recent State Economic Development Initiatives."*

[5] U.S. Bureau of Labor Statistics, *Monthly Labor Review*, June, 1999.

[6] *State Technology and Science Index: Enduring Lessons for the Intangible Economy*. Milken Institute, March 2004.

[7] *State Technology and Science Index: Enduring Lessons for the Intangible Economy*. Milken Institute, March 2004.

[8] National Science Board. *The Science and Engineering Workforce: Realizing America's Potential*. National Science Foundation. Aug, 2003.

[9] R&D Magazine.*R&D Funding Forecast – 2005*. Battelle, January 2005 p. F1-F15

Analysis and reporting by
Mary E. Bruton
Planner

May 2005

580 Harry S. Truman Building
Missouri Economic Research and Information Center
Missouri Department of Economic Development
Jefferson City, MO 65102

TEL: (573) 751-3635
E-MAIL: mary.bruton@ded.mo.gov
WEB: www. missourieconomy.org